

What is claimed:

1. An anti-submarining seat-belt assembly for increasing survival chance of a passenger of a transport system in an accident or during in-flight turbulence, comprising

5 a seat belt, consisting of at least one shoulder belt portion, a lap belt portion and an extending belt portion (1.1 to 1.4);

a main buckle assembly (9.1), having a master release button (84) seat frame (3.3, 3.3a to 3.3d) and arranged to attached to the floor (6) a stiff first transport-system member, generally representing a floor of the transport system adjacent to a first seat-side or a seat-cushion frame at the first seat-side or a mid-tunnel of a motor vehicle adjacent to the first seat-side;

10 a lower belt deflector (17) which, attached to a stiff second transport-system member, which, generally representing the floor of the transport system adjacent to a second seat-side or the seat-cushion frame at the second seat-side or the a post section of the motor vehicle adjacent to the second seat-side or a side rail of the motor vehicle adjacent to the second seat-side, deflects and loosely guides the first and lap belt portion (1.1, 1.3) and the first shoulder belt portion (1.1);

15 at least two latch plates (9, 11, 25), the first of which is a main latch plate (9), moveable along the lap- and shoulder -belt portion, and the second is an anti-submarining latch plate (11, 25), moveable along the lap belt portion; and

20 anti-submarining buckle assemblies, attached to a seat frame of a seat, generally representing the seat-cushion frame or a seat-backrest frame;

whereby

25 a lower body-part of a body (96) of the passenger and an upper body-part (95) are restrained by the lap- and shoulder belt portion when the main latch plate (9) is plug-in connected to the main buckle assembly (9.1); and

the lap belt portion which is subdivided into two anti-submarining belt portions (1.3R, 1.3L) to restrain thighs of the passenger when the anti-submarining latch plate is plug-in connected to one of the anti-submarining buckle assemblies.

30 2. The anti-submarining seat-belt assembly according to claim 1, wherein the anti-submarining buckle assemblies (7, 8, 8a), housings of which are located in the seat cushion (3.1, 3.1a to 3.1d), have a common release button (84o) on the seat where the common release button, when depressed, releases the anti-submarining latch plate.

35 3. The anti-submarining seat-belt assembly according to claim 1, wherein the anti-submarining buckle assembly (8d), housing of which is located on the seat cushion (3.1, 3.1a to 3.1d), is provided with a release button (84d), which, when depressed, releases the anti-submarining latch plate.

40 4. The anti-submarining seat-belt assembly according to claim 2, wherein the master release button (84) is provided with release cables (4.2) connecting to release buttons of the anti-submarining buckle assemblies where the master release button, when depressed, releases the main latch plate and the anti-submarining latch plate from the respective buckle assemblies.

45 5. The anti-submarining seat-belt assembly according to claim 3, wherein the master release button (84) is provided with release cables (4.2) connecting to release buttons of the anti-submarining buckle assemblies where the master release button, when depressed, releases the main latch plate and the anti-submarining latch plate from the respective buckle assemblies.

6. The anti-submarining seat-belt assembly according to claim 2, wherein the master release button (84) is provided with release wires connecting to electrical release-motors (4.2b) of release buttons of the anti-submarining buckle assemblies where the master release button, when depressed, releases the main latch plate and the anti-submarining latch plate from the respective buckle assemblies.

7. The anti-submarining seat-belt assembly according to claim 3, wherein the master release button (84) is provided with release wires connecting to electrical release-motors (4.2b) of release buttons of the anti-submarining buckle assemblies where the master release button, when depressed, releases the main latch plate and the anti-submarining latch plate from the respective buckle assemblies.

8. The anti-submarining seat-belt assembly according to claim 1, wherein the supplement anti-submarining latch plate is a belt-detachable latch plate (25), having a quick-release pin (25.1) and a U-shaped portion to house the lap belt portion which is secured therein by the quick-release pin and detached therefrom by pulling it.

9. The anti-submarining seat-belt assembly according to claim 8, wherein the anti-submarining belt portions are provided with at least one pair of belt-detachable latch plates, which are plug-in connected to the anti-submarining buckle assemblies in the seat cushion at the first and second seat-side to properly restrain the thighs with small circumference.

10. The anti-submarining seat-belt assembly according to claim 9, wherein the master release button (84) is provided with release cables (4.2) connecting to release buttons of the anti-submarining buckle assemblies where the master release button, when depressed, releases the main latch plate and all the anti-submarining latch plates from the respective buckle assemblies.

11. The anti-submarining seat-belt assembly according to claim 10, wherein the anti-submarining latch plates, when not being used, are stored and secured in a storage box (25.5) of the seat.

12. The anti-submarining seat-belt assembly according to claim 1, wherein the anti-submarining latch plates are belt-detachable latch plates (25), each having a quick-release pin (25.1) and a U-shaped portion to house the lap belt portion which is secured therein by the quick-release pin and detached therefrom by pulling it.

13. The anti-submarining seat-belt assembly according to claim 12, wherein the anti-submarining latch plates, when not being used, are stored and secured in a storage box (25.5) of the seat.

14. The anti-submarining seat-belt assembly according to claim 1, wherein the free-moving anti-submarining buckle assembly (8b, 8c), a housing of which is free-moving on the seat cushion, is provided with a release button (84e, 84f) and a length-adjustable belt, attached to the seat frame.

15. The anti-submarining seat-belt assembly according to claim 14, wherein the free-moving anti-submarining buckle assembly is provided with an electrical release-motor (4.2b), which, when receiving an electrical signal emitted from the main buckle assembly resulting from depressing the main release button releasing the main latch plate, pulls the release button to release the anti-submarining latch plate.

16. The anti-submarining seat-belt assembly according to claim 14, wherein the length-adjustable belt is provided with energy absorbers.

17. The multi-point seat belt anti-submarining seat-belt assembly according to claim 14, wherein the length-adjustable belt has a property of absorbing energy.

5 **18.** The multi-point seat belt anti-submarining seat-belt assembly according to claim 16, wherein the length-adjustable belt has a property of absorbing energy.

19. The anti-submarining seat-belt assembly according to claim 1, wherein the anti-submarining buckle assembly is provided with a coupling fitting (1.2a, 1.2b) to receive energy absorbers.

10 **20.** An anti-submarining seat-belt assembly for increasing survival chance of a passenger of a transport system in an accident or during in-flight turbulence, comprising
a two-point seat belt, which is a lap belt portion, a first end of which is fastened to a lower
belt deflector (17) and a second is loosely attached to a main latch plate (9);
a main buckle assembly (9.1), having a master release button (84) and attached to a stiff first
15 transport-system member, generally representing a floor of the transport system adjacent
to a first seat-side or a seat-cushion frame at the first seat-side or a mid-tunnel of a motor
vehicle adjacent to the first seat-side;
the lower belt deflector (17), attached to a stiff second transport-system member, which,
generally representing the floor of the transport system adjacent to a second seat-side or
20 the seat-cushion frame at the second seat-side or a post section of the motor vehicle
adjacent to the second seat-side or a side rail of the motor vehicle adjacent to the second
seat-side;
at least two latch plates (9, 11, 25), the first of which is the main latch plate (9) and the
second is an anti-submarining latch plate (11, 25), moveable along the lap belt portion; and
25 anti-submarining buckle assemblies, attached to a seat frame of a seat, generally representing
the seat-cushion frame or a seat-backrest frame;
whereby
a lower body-part of a body (96) of the passenger is restrained by the lap belt portion when
the main latch plate (9) is plug-in connected to the main buckle assembly (9.1); and
30 the lap belt portion is subdivided into two anti-submarining belt portions (1.3R, 1.3L) to
restrain thighs of the passenger when the anti-submarining latch plate is plug-in connected
to the anti-submarining buckle assembly.